



A Survey of Work and Sleep Hours of U.S. Army Aviation Personnel

By

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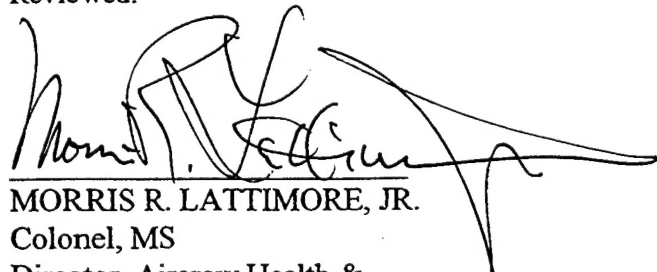
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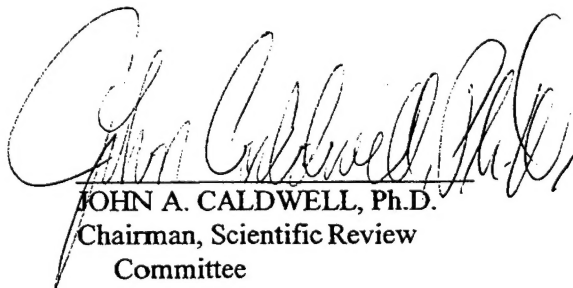
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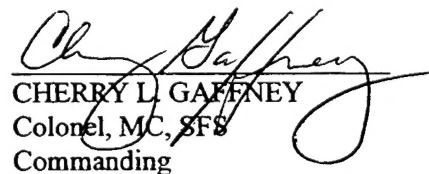


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performance and improved safety, as well as restful sleep during the day. Once the work/rest schedule for a unit is known, countermeasures to address adjustment to reversed sleep/wake cycles can be tailored to the specific needs of the individual or unit.

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General objective

To determine when Army aviation personnel work and sleep while on a reverse cycle, a questionnaire was given to 157 aviation personnel from 3 posts. This information will be used to determine what type of interventions are needed in the aviation community to help aviators perform their tasks most efficiently and adapt to changing work cycles.

Military relevance

In military units, training and missions include nighttime operations. Since all units have different experiences with night operations, it is useful to survey various units to determine how frequently night operations occur, what times of the 24-hour clock they are conducted, and which personnel are involved. Once more is known about how units manage adaptation to night operations, relevant military research can address potential problems in mission schedules, and offer information which can be used to help units conduct their night work in a safe, effective manner.

Background

U.S. Army aviation personnel train and work at different times around the clock. This puts them in a unique situation in which sleep is not easily obtained and performance is compromised due to a lack of adequate rest. Although most people are aware of the consequences of working shifts outside the "normal" work day, it is difficult to schedule the work load so that optimal rest can be obtained. Army units generally do not have a typical shift work schedule as seen in civilian work forces, making it difficult to apply some of the known countermeasures to their situations. Past research has found a wide range of schedules for training in real-world situations (Caldwell and Cornum, 1992; Comperatore et al., 1994; Comperatore et al., 1996), as well as for routine flight training involving flight students and instructor pilots (Comperatore and Allan, 1997).

Since Army aviation personnel have varying schedules, it is necessary to determine what hours they work and when they have opportunities to sleep before researchers can develop studies to devise optimum countermeasures for working reverse cycles. The work hours may depend on whether the personnel are in routine flight training (such as new flight students) or training for a real-world mission. Some personnel may work weeks at a time on reverse cycle, while others may shift from day to night on very short cycles. It is this variation in work cycles which makes it difficult to determine which countermeasures may be useful for certain personnel. In order to design appropriate research which will target the population most in need of help in adjusting to reverse cycle, more information is needed from the aviation units. Therefore, a brief questionnaire was administered to ask questions about how frequently and for how long aviation personnel work reverse cycle, and which hours they work and sleep. The information obtained from this brief survey provided information for future studies concerning adaptation to reverse cycles.

Methods

Subjects

A total of 157 Army aviators and support staff were surveyed. These personnel came from Fort Rucker, Alabama, Fort Campbell, Kentucky, and Fort Benning, Georgia. There were no restrictions on age, rank, gender, etc.

Apparatus

The questionnaire, included in the Appendix, asked questions about when personnel go to work and when they sleep while on reverse cycle. The questionnaire was limited to one page in order to limit the amount of time required to complete it, promoting a higher participation than if a longer questionnaire was used.

Procedure

Commanders of each unit of interest were contacted by a research aviator in advance to gain permission to administer the survey to their units and to schedule a convenient time. The U.S. Army Aeromedical Research Laboratory (USAARL) chief research aviator and one or two technicians visited each Army post in order to distribute the surveys. Each unit to be surveyed was assembled, the purpose of the questionnaire was explained by the research aviator and questions from the volunteers were addressed. Assurance was given that participation was strictly voluntary and that complete anonymity would be maintained throughout. After questions were addressed, the survey was distributed and time given to complete each form. Responders were asked to place their finished survey in an envelope which was collected by the research aviator and technicians.

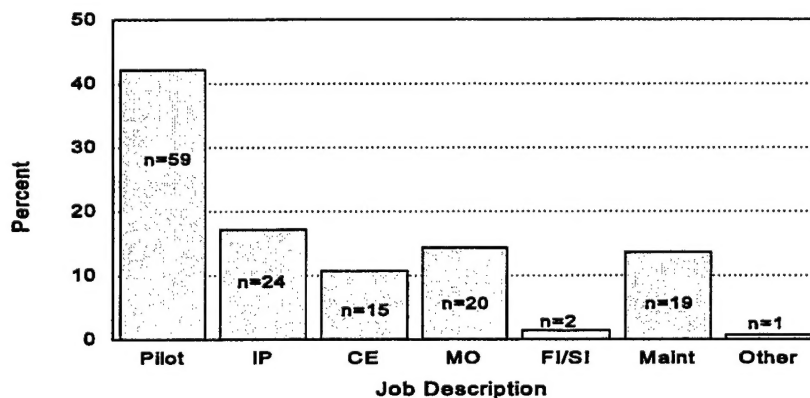
Data analysis

The answers from the questions were tallied and entered into a computerized data base. Analyses were performed using BMDP4F. The data were summarized by the percentage of responders with similar answers to the questions. Those questions with answers which indicated the responder misunderstood the question (i.e., those who stated that reverse cycle hours occurred between 0600 and 1800) were not included in the analysis. For the questions in which a range of times were given, the middle of the range was used for the data point (i.e., those who said their length of reverse cycle was 12 to 14 hours yielded an input of 13 hours). Twelve questionnaires were answered by people who worked 24 hours on, then were off 24 hours. Since these people were in an atypical job series, their questionnaires were not included with the others. The main purpose of the questionnaire was to describe the information concerning work and sleep cycles of aviation units so future protocols may be planned to provide countermeasures for helping soldiers adapt to rotating shift. The data were summarized for total responders as well as in groupings of aviators and nonaviators.

Results

Of the 157 surveys collected, most included usable data. Twelve questionnaires were not included in the total analysis due to the odd work hours of this group (they worked 24-hour shifts every other day). This left a total of 145 questionnaires. Of these remaining surveys, many had answers which indicated that the questions were misunderstood by the respondents and were therefore not included in the tally. For this reason, many of the questions have a different total number of respondents. All questions are summarized in a table or graph with the percentages of the total number of responders for that question; raw numbers are displayed in parentheses or on the bar in the graph. Only the most relevant items will be discussed.

The demographics of the responders were surveyed, including position, rank, age, years in service and number of flight hours. Of the responders who answered the job category question, 59.2% were aviators while the remainder were crew chiefs (10.7%), medical observers (14.3%), flight instructors or standardization instructors (1.4%), maintenance workers (13.6%), or other (0.7%) (Figure 1). The majority of responders were officers (57.8%), with the remaining being enlisted (38.6%) or civilians (3.6%) (Figure 2). Most of the respondents were under 35 years of age, with 29.0% from 26-30 years of age and 29.0% from 31-35 years of age. More of the aviators were in the latter age category (22.5%) than in the former (15.2%). A breakdown of the ages is shown in Table 1.



IP = Instructor Pilot; CE = Crew Chief; MO = Flight Surgeon or other medical personnel; FI/SI = Flight/Standardization Instructor; Maint = Maintenance

Figure 1. Job categories of responders.

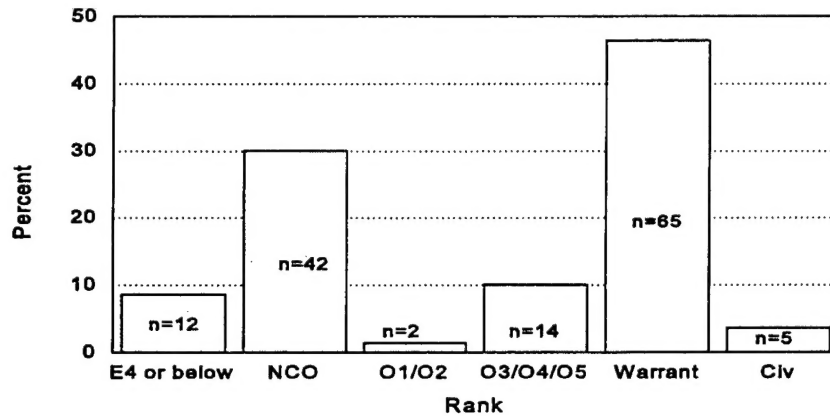


Figure 2. Ranks of responders.

Table 1.
Responders' ages.

Age	≤ 25	26-30	31-35	36-40	41-45	46-50	> 50
Aviators	0.7% (1)	15.2% (21)	22.5% (31)	14.5% (20)	5.1% (7)	1.4% (2)	0.7% (1)
Nonaviators	12.3% (17)	13.8% (19)	6.5% (9)	2.9% (4)	4.3% (6)	0.0% (0)	0.0% (0)
Total	13.0% (18)	29.0% (40)	29.0% (40)	17.4% (24)	9.4% (13)	1.4% (2)	0.7% (1)

Most of the responders had 15 years or less of military service (74.0%). A full description of the years in service is depicted in Table 2. The majority of the responders had flight hours totaling 1500 or less (60.2%) (Figure 3). A bimodal distribution was seen in total night vision devices/night goggle (NVD/NG) hours with a high percentage below 100 hours (29.5%) and another group above 350 hours (41.1%). The other 29.6% was distributed between these two points (see Figure 4). A similar pattern was seen for total night hours with the majority having less than 200 (71.7%) and another smaller peak occurring at more than 600 hours (15.2%). The distribution is shown in Figure 5.

Table 2.
Years in service.

Years	≤ 5	6-10	11-15	16-20	21-25	> 25
Aviators	3.1% (4)	15.0% (19)	25.2% (32)	15.0% (19)	3.1% (4)	2.4% (3)
Nonaviators	10.2% (13)	11.8% (15)	8.7% (11)	4.7% (6)	0.8% (1)	0.0% (0)
Total	13.3% (17)	26.8% (34)	33.9% (43)	19.7% (25)	3.9% (5)	2.4% (3)

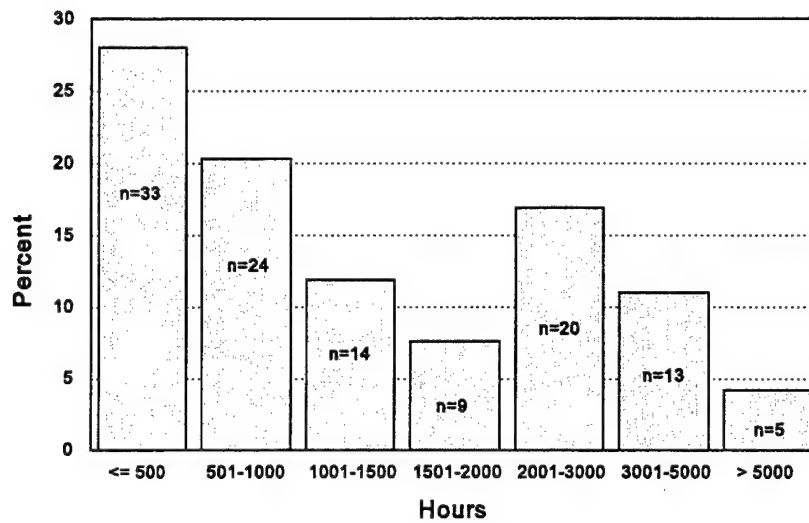


Figure 3. Total flight hours.

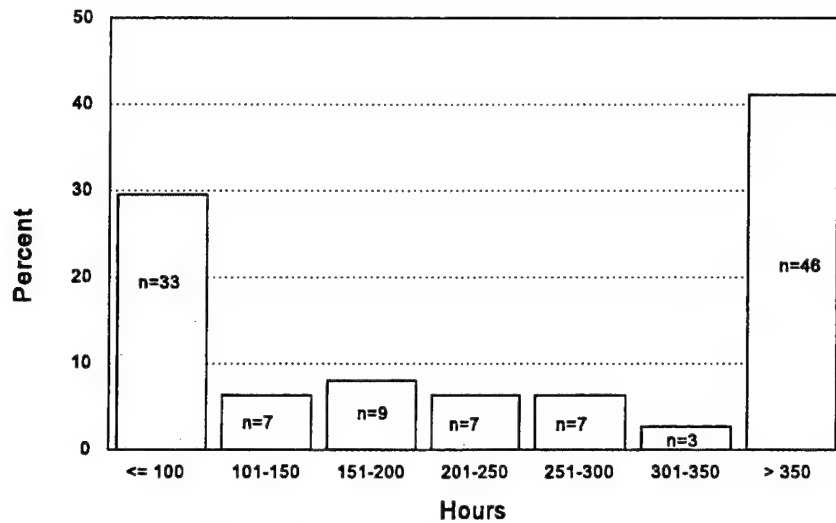


Figure 4. Total NVD/NVG hours.

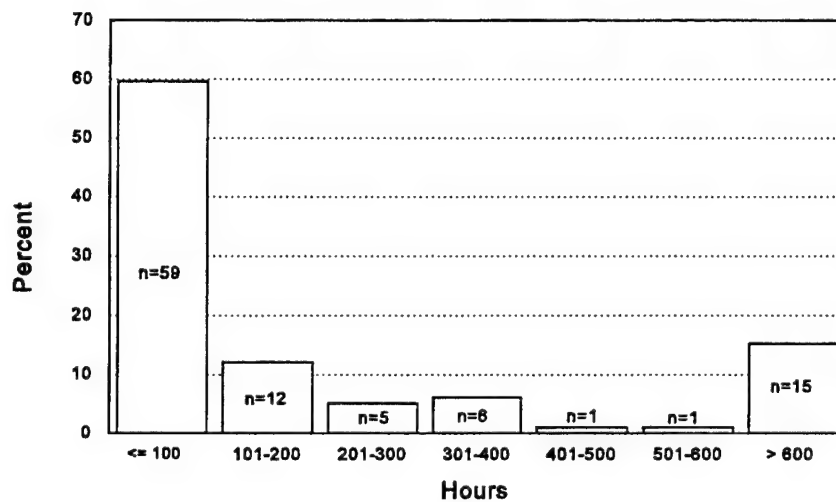


Figure 5. Total night flight hours.

The next three questions of the survey dealt with the usual bedtimes and risetimes and the usual hours of work. As indicated in Table 3, the majority of responders retired for the evening between 2201 and 2300 (53.6%) and the majority of rise times usually occurred between 0501 and 0600 (49.6%). About 20% of the nonaviators showed rise times between 0400 and 0500 while only 8.6% of the aviators had rise times this early (see Table 3).

Table 3.
Bedtimes and rise times of responders.

Question 1. What time go to sleep usually

Time of day	Before 2100	2100- 2200	2201- 2300	2301- 2400	0001- 0100	0101- 0200
Aviators	0.0% (0)	14.3% (20)	34.3% (48)	7.1% (10)	2.2% (3)	0.7% (1)
Nonaviators	0.7% (1)	12.8% (18)	19.3% (27)	7.1% (10)	1.4% (2)	0.0% (0)
Total	0.7% (1)	27.1% (38)	53.6% (75)	14.3% (20)	3.6% (5)	0.7% (1)

Question 2. What time arise from sleep usually

Time of day	0400- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
Aviators	8.6% (12)	29.5% (41)	15.8% (22)	3.6% (5)	0.7% (1)	0.7% (1)
Nonaviators	19.4% (27)	20.1% (28)	0.7% (1)	0.7% (1)	0.0% (0)	0.0% (0)
Total	28.1% (39)	49.6% (69)	16.5% (23)	4.3% (6)	0.7% (1)	0.7% (1)

Question 3 dealt with work times -- both when one reported to work and when one left work. Of the responders to this question, the majority went to work before 0700 (48.5%), and left work between 1701 and 1800 (48.5%). The distributions are shown in Table 4.

Question 4 asked if the responder had ever worked night shift/reverse cycle. Of the 141 responders to this question, 95.7% answered "yes." Table 5 describes the responses from aviators and nonaviators.

Table 4.
Work times for responders.

Question 3. What time go to work usually							
Time of day	Before 0700	0700- 0800	0801- 0900	0901- 1000	1001- 1100	1101- 1200	After 1200
Aviators	18.3% (25)	14.7% (20)	11.8% (16)	10.3% (14)	0.7% (1)	0.7% (1)	2.9% (4)
Nonaviators	30.1% (41)	5.9% (8)	0.7% (1)	3.7% (5)	0.0% (0)	0.0% (0)	0.0% (0)
Total	48.5% (66)	20.6% (28)	12.5% (17)	14.0% (19)	9.7% (1)	0.7% (1)	2.9% (4)

What time go home from work usually						
Time of day	1500- 1600	1601- 1700	1701- 1800	1801- 1900	1901- 2000	2001- 2100
Aviators	0.8% (1)	6.1% (8)	32.6% (43)	15.2% (20)	3.8% (5)	0.8% (1)
Nonaviators	0.0% (0)	1.5% (2)	15.9% (21)	17.4% (23)	5.3% (7)	0.8% (1)
Total	0.8% (1)	7.6% (10)	48.5% (64)	32.6% (43)	9.1% (12)	1.5% (2)

Table 5.
Night shift/reverse cycle experience.

Question 4. Ever worked night shift/reverse cycle

Response	Yes	No
Aviators	57.4% (81)	1.4% (2)
Nonaviators	38.3% (54)	2.8% (4)
Total	95.7% (135)	4.3% (6)

The remainder of the survey was to be answered only if the responder had experience working night shift/reverse cycle. In addition, the responder was to answer the questions based on his/her most recent experience working night shift/reverse cycle. Many of the responders did not follow these directions, answering more than one response for a question (i.e., choosing "garrison," and "field" for question F). When this occurred, the responder's answer was not included in the analysis.

The majority of responders indicated that the number of times their unit participated in night shift/reverse cycle operations was four or more times a year (60.9%). The reason for conducting night shift/reverse cycle operations was usually unit training (81.5%). This question was not answered correctly by many responders; several people responded by choosing both training and deployment rather than choosing only one answer. When this occurred, the question was keyed in as "training" for that responder. The summary of the information for deployment is presented in Table 6.

Table 6.
Night shift/reverse cycle frequency and purpose.

Question A. How many times per year does unit conduct night shift/reverse cycle operations?

Number	1 time/year	2-3 times/year	> 4 times/year
Aviators	9.0% (12)	13.5% (18)	38.3% (51)
Nonaviators	7.5% (10)	9.0% (12)	22.6% (30)
Total	16.5% (22)	22.6% (30)	60.9% (81)

Question B. Reason for night shift/reverse cycle

	Training	Deployment
Aviators	49.2% (64)	13.1% (17)
Nonaviators	32.3% (42)	5.4% (7)
Total	81.5% (106)	18.5% (24)

The majority of responders (81.1%) were assigned to a field unit or TOE (Table of Organization and Equipment) while only a small percentage (12.9%) were assigned to a garrison or TDA (Table of Distributions and Allowances) unit. This information is depicted in Figure 6.

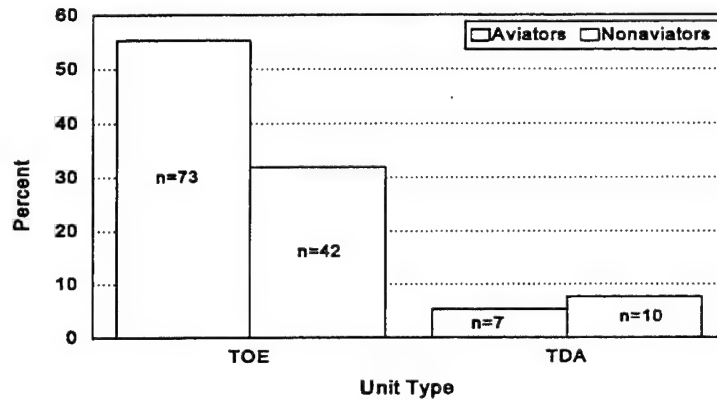


Figure 6. Type of unit assigned.

Most responders were currently working or had worked night shift/reverse cycle within the past 6 months (69.4%), while only 8.2% had not worked this cycle in at least 2 years. The description of this question is shown in Table 7.

Table 7.
Time since last night shift/reverse cycle.

Question D. When last worked night shift/reverse cycle?

Time	Now	0-6 months	6-12 months	12-24 months	> 24 months
Aviators	4.5% (6)	41.0% (55)	5.2% (7)	5.2% (7)	3.7% (5)
Nonaviators	1.5% (2)	22.4% (30)	9.7% (13)	2.2% (3)	4.5% (6)
Total	6.0% (8)	63.4% (85)	14.9% (20)	7.5% (10)	8.2% (11)

Questions E and F dealt with the length of the night shift/reverse cycle periods and where the shift was conducted. The length of the majority of the periods was 14 days or less (87.2%), with about half from 2 to 5 days (47.0%) and slightly less than half from 6 to 14 days (40.2%). This distribution occurred for both aviators and nonaviators. The question concerning where the night shift/reverse cycle periods were usually conducted was commonly given more than one answer by the respondent. When this occurred, the respondent's answer was not included in the analysis. Of the answers in which only one response was given, many of the aviators indicated a field setting (35.4%), whereas there was a more equal split between garrison and field for the nonaviators (18.8% and 16.7%, respectively). Table 8 describes these questions.

Table 8.
Length of night shift/reverse cycle periods and where conducted.

Question E. How long are night shift/reverse cycle periods?

Time	2-5 days	6-14 days	15-30 days	> 30 days
Aviators	25.8% (34)	26.5% (35)	6.1% (8)	1.5% (2)
Nonaviators	21.2% (28)	13.6% (18)	5.3% (7)	0.0% (0)
Total	47.0% (62)	40.2% (53)	11.4% (15)	1.5% (2)

Question F. Where was night shift/reverse cycle conducted?

	Garrison	Field	Home
Aviators	20.8% (20)	35.4% (34)	5.2% (5)
Nonaviators	18.8% (18)	16.7% (16)	3.1% (3)
Total	39.6% (38)	52.1% (50)	8.3% (8)

Questions G and H asked about the number of times per month a person worked night shift/reverse cycle, including the number of times these nights were consecutive. The majority of responders were spread across the range from 3 to more than 10 nights per month (96.9%), with a large group indicating more than 10 nights per month (35.1%). About half of the responders indicated that from 3 to 6 of these nights occurred consecutively (53.9%). The descriptions of questions G and H are shown in Table 9.

Of the nights per month worked, 49.6% indicated that from 3 to 6 of these nights involved flying the aircraft, with 71.4% of the responders indicating that 1 to 6 of these nights were consecutive, with the largest proportion indicating 3 to 4 consecutive nights (34.9%). The majority of responders (70.2%) indicated that on the nights the aircraft was flown, the flight hours ranged from 1 to 5 per night. The descriptions of questions I through K are shown in Table 10.

Table 9.
Descriptions of nights worked per month.

Nights	0	1-2	3-4	5-6	7-8	9-10	> 10
Question G. How many nights worked/month on night shift/reverse cycle							
Aviators	0.8% (1)	0.0% (0)	9.2% (12)	6.9% (9)	8.4% (11)	11.5% (15)	24.4% (32)
Nonaviators	0.8% (1)	1.5% (2)	5.3% (7)	7.6% (10)	6.1% (8)	6.9% (9)	10.7% (14)
Total	1.5% (2)	1.5% (2)	14.5% (19)	14.5% (19)	14.5% (19)	18.3% (24)	35.1% (46)
Question H. How many consecutive nights worked/month on night shift/reverse cycle							
Aviators	3.8% (5)	6.9% (9)	19.2% (25)	15.4% (20)	5.4% (7)	3.1% (4)	7.7% (10)
Nonaviators	4.6% (6)	4.6% (6)	8.5% (11)	10.8% (14)	1.5% (2)	3.8% (5)	4.6% (6)
Total	8.5% (11)	11.5% (15)	27.7% (36)	26.2% (34)	6.9% (9)	6.9% (6)	12.3% (16)

When discussing the number of hours in a 24-hour period the responder worked when scheduled for night shift/reverse cycle, most responders indicated a total work period between 8 and 14 hours (77.2%). Very few worked less than an 8-hour day (9.9%), and few indicated working longer than a 14-hour day (12.9%). The description of each category is shown in Table 11.

Table 10.
Descriptions of nights flown per month.

Nights	0	1-2	3-4	5-6	6-7	9-10	> 10
Question I. How many nights fly/month on night shift/reverse cycle							
Aviators	9.4% (12)	0.0% (0)	22.8% (29)	11.0% (14)	7.1% (9)	4.7% (6)	7.9% (10)
Nonaviators	16.5% (21)	0.0% (0)	8.7% (11)	7.1% (9)	0.8% (1)	0.8% (1)	3.1% (4)
Total	26.0% (33)	0.0% (0)	31.5% (40)	18.1% (23)	7.9% (10)	5.5% (7)	11.0% (14)
Question J. How many consecutive nights fly/month on night shift/reverse cycle							
Aviators	3.2% (4)	12.7% (16)	27.0% (34)	14.3% (18)	3.2% (4)	0.8% (1)	2.4% (3)
Nonaviators	14.3% (18)	6.3% (8)	7.9% (10)	3.2% (4)	0.8% (1)	0.8% (1)	3.2% (4)
Total	17.5% (22)	19.0% (24)	34.9% (44)	17.5% (22)	4.0% (5)	1.6% (2)	5.6% (7)
Question K. How many hours fly/night on night shift/reverse cycle?							
Hours	0	1	2	3	4	5	
Aviators	0.9% (1)	1.9% (2)	15.9% (17)	15.0% (16)	15.9% (17)	11.2% (12)	
Nonaviators	14.0% (15)	0.0% (0)	13.1% (14)	5.6% (6)	4.7% (5)	1.9% (2)	
Total	15.0% (16)	1.9% (2)	29.0% (31)	20.6% (22)	20.6% (22)	13.1% (14)	

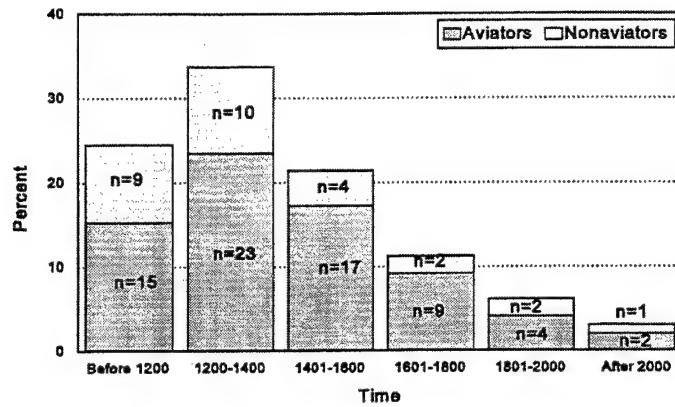
Table 11.
Hours worked per 24-hour period.

Question L. How many hours/24 hours work on night shift/reverse cycle?

Hours	≤ 5	6-7	8-10	11-12	12-14	>14
Aviators	0.8%	1.5%	15.2%	18.9%	19.7%	5.3%
	(1)	(2)	(20)	(25)	(26)	(7)
Nonaviators	6.8%	0.8%	9.1%	9.8%	4.5%	7.6%
	(9)	(1)	(12)	(13)	(6)	(10)
Total	7.6%	2.3%	24.2%	28.8%	24.2%	12.9%
	(10)	(3)	(32)	(38)	(32)	(17)

Questions M and N inquired about when the responders reported to work when on night shift/reverse cycle and when they went home following the work period. The largest peak indicated responders went to work between 1200 and 1400 (33.7%), followed by "before 1200" (24.5%) and between "1401 and 1600" (21.4%). The time in which most responders returned home following night work varied, but the largest peak occurred after 0800 (29.2%), followed by two others occurring between 0201 and 0300 (19.1%) and between 0301 and 0400 (15.7%). These results are depicted in Figure 7.

Question M. What time go to work on night shift/reverse cycle?



Question N. What time go home after night shift/reverse cycle?

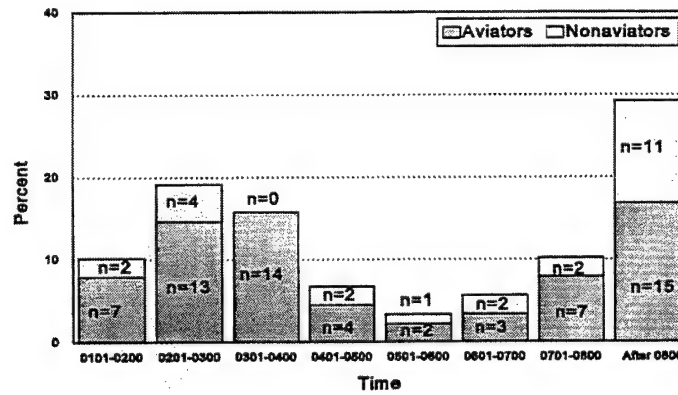


Figure 7. Duty hours when working night shift/reverse cycle.

Of interest was the time one went to work (Question M) compared to the time one went home from work (Question N). The largest two groups reported to work before 1200 and went home after 0700 (25.0%), or reported to work between 1200 and 1400 and went home after 0800 (12.5%). The largest group of responders on nights shift/reverse cycle worked about a 10 to 12 hour day, reporting to work in the afternoon (1200-1800), but returning home by early morning (0600) (40.7%). A few of the responders reported working a 12 to 14 hour day, going to work in the evening around 1800 to 2000 and returning home by 0800 (6.8%). See Table 12 for a description of these questions.

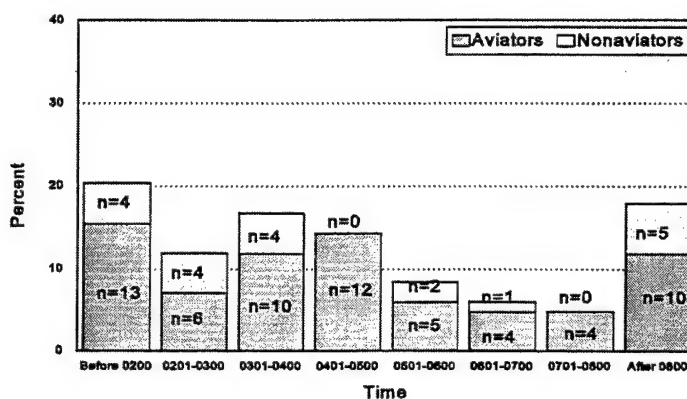
Table 12.

What time responders went home from work depending on what time they reported to work (both aviators and nonaviators combined).

Question N. What time go home from work	Question M. What time go to work					
	Before 1200	1200-1400	1401-1600	1601-1800	1801-2000	After 2000
0100-0200	0.0% (0)	5.7% (5)	3.4% (3)	1.1% (1)	0.0% (0)	0.0% (0)
0201-0300	8.0% (7)	9.1% (8)	2.3% (2)	0.0% (0)	0.0% (0)	0.0% (0)
0301-0400	3.4% (3)	6.8% (6)	3.4% (3)	2.3% (2)	0.0% (0)	0.0% (0)
0401-0500	2.3% (2)	1.1% (1)	1.1% (1)	1.1% (1)	1.1% (1)	0.0% (0)
0501-0600	0.0% (0)	1.1% (1)	1.1% (1)	1.1% (1)	0.0% (0)	0.0% (0)
0601-0700	0.0% (0)	0.0% (0)	1.1% (1)	2.3% (2)	2.3% (2)	0.0% (0)
0701-0800	14.8% (13)	0.0% (0)	2.3% (2)	1.1% (1)	1.1% (1)	2.3% (2)
After 0800	10.2% (9)	12.5% (11)	3.4% (3)	1.1% (1)	1.1% (1)	0.0% (0)

A related question was what time a person went to bed following night shift/reverse cycle and when he/she arose from sleep. Questions O and P addressed these two issues. The times reflected the results from question N fairly well, with a variety of times reported. The majority of responders indicated they retired after their work shift by 0500 (61.9%), with fairly a equal number of responses indicated for the categories from "before 0200" until "0401-0500". A peak occurred between 0801 and 0900 (13.1%). For rise times, the largest number of responders reported times between 0901 and 1100 (37.2%); however, the range of answers stretched across the day. These data are shown in Figure 8.

Question O. What time go to sleep after night shift/reverse cycle?



Question P. What time get up from last sleep period after night shift/reverse cycle?

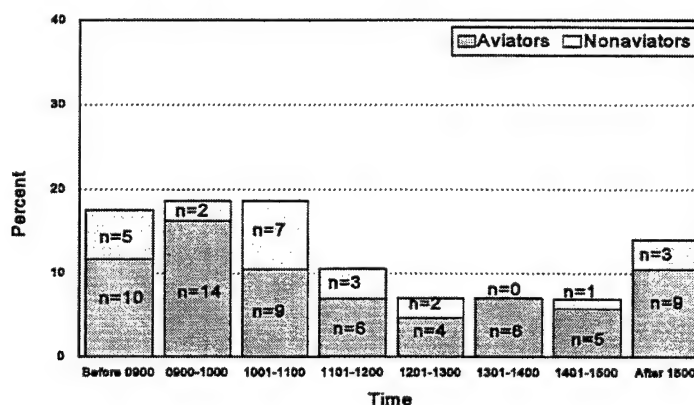


Figure 8. Sleep periods following night shift/reverse cycle.

Based on cross tabulations of the answers from questions O and P, reported bedtimes and waketimes indicated the majority of responders obtained at least 7 hours of sleep following a night shift (52.1%). Table 13 shows the reported wake times associated with reported bedtimes.

Table 13.
Sleep time based on reported sleep onset and wake times.

Question P. What time get up from sleep	Question O. What time go to sleep after work									
	Before 0100	0100- 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
Before 0800	0.0% (0)	3.9% (3)	2.6% (2)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
0901-0900	1.3% (1)	2.6% (2)	3.9% (3)	1.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
0901-1000	0.0% (0)	6.6% (5)	1.3% (1)	6.6% (5)	2.6% (2)	0.0% (0)	1.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)
1001-1100	0.0% (0)	2.6% (2)	2.6% (2)	3.9% (3)	7.9% (6)	2.6% (2)	0.0% (0)	0.0% (0)	1.3% (1)	0.0% (0)
1101-1200	0.0% (0)	1.3% (1)	1.3% (1)	3.9% (3)	2.6% (2)	1.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
1201-1300	0.0% (0)	2.6% (2)	0.0% (0)	1.3% (1)	0.0% (0)	0.0% (0)	1.3% (1)	1.3% (1)	1.3% (1)	0.0% (0)
1301-1400	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.6% (2)	1.3% (1)	1.3% (1)	2.6% (2)	0.0% (0)	0.0% (0)
1401-1500	0.0% (0)	0.0% (0)	0.0% (0)	1.3% (1)	0.0% (0)	1.3% (1)	1.3% (1)	1.3% (1)	0.0% (0)	0.0% (0)
1501-1600	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	3.9% (3)	1.3% (1)
After 1600	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	3.9% (3)	3.9% (3)

Of interest was when people went to sleep after returning home from work. When crossed with when the respondent went to bed, most reported a bedtime within 2 hours after leaving work. As can be seen from Table 14, several indicated leaving work after 0800, but going to sleep in the early morning. This may indicate a misinterpretation of the questions by these responders, or it may indicate that some of them stayed awake after returning home from a night shift until their "normal" bedtime the next night.

Table 14.

What time responders go to sleep after work dependent on what time they go home from work.

Question O. What time go to sleep after work	Question N. What time go home from work							
	Before 0200	0201- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	After 0800
Before 0100	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	1.3% (1)
0101-0200	3.8% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	14.1% (11)
0201-0300	5.1% (4)	3.8% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.6% (2)
0301-0400	2.6% (2)	11.5% (9)	2.6% (2)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	1.3% (1)
0401-0500	0.0% (0)	5.1% (4)	10.3% (8)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
0501-0600	0.0% (0)	0.0% (0)	2.6% (2)	3.8% (3)	2.6% (2)	0.0% (0)	0.0% (0)	0.0% (0)
0601-0700	0.0% (0)	1.3% (1)	1.3% (1)	3.8% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
0701-0800	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	1.3% (1)	2.6% (2)	1.3% (1)	0.0% (0)
0801-0900	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.6% (2)	6.4% (5)	2.6% (2)
After 0900	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	1.3% (1)	2.6% (2)

The question concerning how people slept after a night shift was addressed. Many of the responders indicated they slept straight through after night shift (71.5%) rather than napped during the day. For those who did nap, most reported one to two naps per day (81.4%) for a total of more than 7 hours of sleep (77.9%). The responses from each of these questions are depicted in Table 15.

Table 15.
Type of sleep when on night shift/reverse cycle.

Question Q. After a night shift/reverse cycle, do you sleep straight through or nap?

Type of day sleep	Straight through	Nap
Aviators	46.2% (60)	16.2% (21)
Nonaviators	25.4% (33)	12.3% (16)
Total	71.5% (93)	28.5% (37)

If napped, how many naps?

Number	1	2	3	4
Aviators	22.2% (6)	33.3% (9)	3.7% (1)	3.7% (1)
Nonaviators	14.8% (4)	11.1% (3)	11.1% (3)	0.0% (0)
Total	37.0% (10)	44.4% (12)	14.8% (4)	3.7% (1)

Total duration of sleep (hours), regardless of how sleep occurred?

Number	1	2-3	4-5	6-7	>7
Aviators	1.6% (2)	4.9% (6)	3.3% (4)	3.3% (4)	50.8% (62)
Nonaviators	0.8% (1)	4.9% (6)	2.5% (3)	0.8% (1)	27.0% (33)
Total	2.5% (3)	9.8% (12)	5.7% (7)	4.1% (5)	77.9% (95)

Table 16.
Type of sleep relative to time of sleep onset.

Question Q. Type of sleep obtained after night shift	Question O. What time go to sleep after work								
	Before 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
Straight through	18.1% (15)	10.8% (9)	15.7% (13)	12.0% (10)	6.0% (5)	6.0% (5)	3.6% (3)	6.0% (5)	1.2% (1)
Napped	2.4% (2)	1.2% (1)	1.2% (1)	2.4% (2)	2.4% (2)	0.0% (0)	1.2% (1)	6.0% (5)	3.6% (3)

The time when a person went to bed did not seem to exert a major impact on whether the person napped or slept straight through in one sleep period. Some responders were able to go to sleep by 0600 and sleep straight through a single sleep period (62.6%), while only a small percentage (9.6%) napped (Table 16). Of those who reported napping, more people with a late bed time (after 0400) reported 2 or 3 napping periods (78.3%) compared to those with early bedtimes (7.1%) (Table 17). The majority of people reported a total of more than 7 hours of sleep (81.8%), regardless of time to bed (Table 18).

Table 17.
Number of naps taken relative to time of sleep onset.

Question Q. How many naps taken	Question O. What time go to sleep after work								
	Before 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
1	7.1% (1)	7.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	7.1% (1)
2	0.0% (0)	0.0% (0)	7.1% (1)	7.1% (1)	14.3% (2)	0.0% (0)	7.1% (1)	21.4% (3)	7.1% (1)
3	0.0% (0)	0.0% (0)	0.0% (0)	7.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)	7.1% (1)	0.0% (0)

When asked how many total *quality* hours of sleep the responders obtained when on night shift/reverse cycle, many of the responders indicated from 6 to 7 hours per 24-hour period (48.9%) with another large group reporting 4 to 5 hours per 24-hour period (32.8%). When asked whether they felt they received adequate sleep when working night shift/reverse cycle, the majority of responders indicated "some of the time" (51.5%) and about one third "most of the time" (36.6%). These data are shown in Table 19.

Table 18.
Hours of reported sleep relative to time of sleep onset.

Question Q. Total duration of sleep periods	Question O. What time go to sleep after work								
	Before 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
0-1 hour	0.0% (0)	1.2% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
2-3 hours	1.2% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	3.7% (3)	1.2% (1)
4-5 hours	1.2% (1)	0.0% (0)	0.0% (0)	1.2% (1)	1.2% (1)	0.0% (0)	0.0% (0)	2.4% (2)	0.0% (0)
6-7 hours	0.0% (0)	0.0% (0)	1.2% (1)	0.0% (0)	1.2% (1)	0.0% (0)	1.2% (1)	0.0% (0)	1.2% (1)
> 7 hours	18.3% (15)	11.0% (9)	15.9% (13)	13.4% (11)	6.1% (5)	6.1% (5)	3.7% (3)	6.1% (5)	1.2% (1)

Table 19.
Subjective quality of sleep during night shift/reverse cycle.

Question R. How many total quality hours of sleep obtain in 24-hour period while working night shift/reverse cycle?

Hours	0-1	2-3	4-5	6-7	> 7
Aviators	0.0% (0)	2.3% (3)	19.8% (26)	32.8% (43)	6.9% (9)
Nonaviators	0.8% (1)	1.5% (2)	13.0% (17)	16.0% (21)	6.8% (9)
Total	0.8% (1)	3.8% (5)	32.8% (43)	48.9% (64)	13.7% (18)

Question T. Obtain adequate daytime sleep after night shift/reverse cycle?

Adequate daytime sleep	Not at all	Some of the time	Most of the time	All the time
Aviators	5.2% (7)	31.3% (42)	23.9% (32)	0.0% (0)
Nonaviators	5.3% (7)	20.1% (27)	12.7% (17)	1.5% (2)
Total	10.4% (14)	51.5% (69)	36.6% (49)	1.5% (2)

When bedtimes were considered, only 1.9% of the responders indicated more than 7 hours of *quality* sleep were obtained when working night shift/reverse cycle. If sleep onset occurred after 0600, only 3.6% of the responders indicated they obtained more than 7 hours of quality sleep, while 14.3% reported more than 7 hours if sleep onset occurred before 0600 (Table 20).

Table 20.
Total hours of *quality* sleep dependent on time of sleep onset.

Question R. Total hours of quality sleep	Question O. What time go to sleep after work								
	Before 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
0-1 hour	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
2-3 hours	0.0% (0)	0.0% (0)	0.0% (0)	1.2% (1)	0.0% (0)	0.0% (0)	0.0% (0)	1.2% (1)	0.0% (0)
4-5 hours	2.4% (2)	4.8% (4)	4.8% (4)	6.0% (5)	3.6% (3)	0.0% (0)	3.6% (3)	4.8% (4)	2.4% (2)
6-7 hours	8.3% (7)	6.0% (5)	10.7% (9)	4.8% (4)	4.8% (4)	6.0% (5)	1.2% (1)	3.6% (3)	2.4% (2)
> 7 hours	9.5% (8)	1.2% (1)	1.2% (1)	2.4% (2)	0.0% (0)	0.0% (0)	0.0% (0)	3.6% (3)	0.0% (0)

When rating the adequacy of daytime sleep, only 8.4% of the responders who went to bed after 0600 rated their sleep as adequate “most” or “all of the time,” while 32.27% of the responders who went to bed before 0600 rated their sleep as adequate “most” or “all of the time.”

Table 21.
Subjective sleep quality dependent on time of sleep onset.

Question S. Adequate daytime sleep	Question O. What time go to sleep after work								
	Before 0200	0200- 0300	0301- 0400	0401- 0500	0501- 0600	0601- 0700	0701- 0800	0801- 0900	After 0900
Not at all	1.2% (1)	1.2% (1)	0.0% (0)	1.2% (1)	0.0% (0)	0.0% (0)	1.2% (1)	1.2% (1)	1.2% (1)
Some of the time	6.0% (5)	7.1% (6)	10.7% (9)	6.0% (5)	6.0% (5)	3.6% (3)	2.4% (2)	6.0% (5)	2.4% (2)
Most of the time	13.1% (11)	3.6% (3)	6.0% (5)	7.1% (6)	2.4% (2)	2.4% (2)	1.2% (1)	3.6% (3)	1.2% (1)
All the time	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.4% (2)	0.0% (0)

Question S addressed the number of years one had worked night shift/reverse cycle. Many of the responders indicated limited experience, with a cluster around 1 to 3 years (35.0%) and another cluster around 6 to 10 years (31.7%). The results of this question are shown in Table 22.

Table 22.
Years experience on night shift/reverse cycle.

Question S. How many years experience on night shift/reverse cycle?

Years	1-3	4-5	6-10	11-15	> 15
Aviators	16.3% (20)	8.1% (10)	22.8% (28)	8.9% (11)	5.7% (7)
Nonaviators	18.7% (23)	7.3% (9)	8.9% (11)	0.8% (1)	2.4% (3)
Total	35.0% (43)	15.4% (19)	31.7% (39)	9.8% (12)	8.1% (10)

Discussion

While some of the questions on this survey were misinterpreted by the responders, the objective of the study was met -- what times aviators worked when on night shift/reverse cycle

and what times they slept. Not surprisingly, the majority of aviators had experience working night shift/reverse cycle at some point in their careers; however, over one third had not dealt with night work for more than 3 years. Thus, they probably have not developed adequate coping strategies for this type of work schedule. Usually the night shift occurred from early in the afternoon to early in the morning, with aviators arriving at home after 0800. However, a large group of responders returned home from the night shift by 0400. This information is useful when determining which countermeasures to recommend to aviators to help them adjust to night shift/reverse cycle work. When returning home from work well before dawn, adjustment will occur more easily than returning home from work after sunrise.

Although most of the responders indicated they were able to sleep after a night shift for at least 7 hours, many of them indicated they did not feel they received adequate daytime sleep most or some of the time. Whether or not restful sleep is obtained before returning to work will help determine whether sleepiness will be a problem during the work period and whether performance will suffer as a result.

Although many aviators reported returning home by 0400 after night flights, there is a large percentage who indicated they did not return home until after 0800, making it difficult to obtain adequate daytime sleep. The time in which sleep was initiated (either before 0400 or after 0600) seemed to affect whether the subsequent sleep was adequate or not. This is a typical response from night workers, with the chief complaint being that sleep is difficult to maintain when the sleep period begins well after sunrise. These results indicate that research is needed to address the issue of helping aviators sleep during the daytime hours, both for training exercises and for deployment. Techniques for adjusting to night shift should emphasize enhanced alertness during the night with high performance and improved safety, as well as restful sleep during the day. Once the work/rest schedule for a unit is known, countermeasures to address adjustment to reversed sleep/wake cycles can be tailored to the specific needs of the individual or unit.

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Appendix
Questionnaire.

A Survey of Work and Sleep Hours of U.S. Army Aviation Personnel

The U.S. Army Aeromedical Research Laboratory (USAARL) conducts research pertaining to reverse work cycles. In order to design aviation-relevant research, it is important to know how aviators schedule their days and nights when working reverse cycles. You can help provide this information by completing the following survey. *At no time will your name or any association with you or your unit be identified with the questionnaire.* The only personal information we ask is your age in order to help describe the data in a meaningful way. *Participation in this survey is completely voluntary and will in no way reflect upon your performance ratings, etc.* Should you begin to answer the questionnaire and decide you would rather not continue, you may stop at any time without penalty. If you have any questions concerning the survey, please ask the representative who delivered the questionnaire to you. Answer each question to the best of your knowledge. Comments are welcome on the back of the form.

Upon completion of the survey, please return it to the designated area so it can be collected by the USAARL representative. Once this is done, your participation is complete. Thank you for your time and information.



PLEASE DO NOT PUT ANY IDENTIFYING INFORMATION ON THIS FORM

1. Please circle the appropriate job:

Pilot IP UT CE MO FI/SI Maintenance Aviation/Flight Student

2. Rank/Grade _____ Age: _____ TIS: (yr/mo) _____

3. For Pilots/Crewmembers: (Military flight hours only)

Total flight hours _____ Total NVD/NG hours _____ Total night hours _____

4. Most of the time, what time do you go to sleep? _____

5. Most of the time, what time do you get up from sleep? _____

6. Most of the time, what are your work hours? _____

7. Have you ever worked night shift/reverse cycle (NS/REV)? *Yes No*

If yes, please answer the following based on your most recent experience (please be specific -- i.e., clock times)

A. How many times per year do/did you/your unit conduct NS/REV operations?

1 time/year 2-3 times/year 4 or more times/year

B. Was/is your NS/REV conducted for routine training (unit/ATM) or for deployment/preparation?

Training Deployment

C. What type is your unit? *TOE TDA*

D. When did you last work NS/REV? *On NS/REV now 0-6 mo 6-12 mo 12-24 mo > 24 months*

E. How long were the NS/REV periods in your unit? *2-5 days 6-14 days 15-30 days >30 days*

F. Was your NS/REV conducted in garrison, in the field, or from home? *Garrison Field Home*

G. How many nights do/did you work in a typical month? (on NS/REV) _____

H. How many consecutive nights do/did you usually work on NS/REV? _____

I. How many nights do/did you fly during a typical NS/REV period? _____

J. How many consecutive nights do/did you usually fly on NS/REV period? _____

K. How many hours do/did you typically fly per night while on NS/REV? _____

L. How many hours in a 24-hour period do/did you work on a NS/REV? _____

M. What time do/did you usually go to work? _____

N. What time do/did you usually go home (include after work social times)? _____

O. What time do/did you typically go to sleep? (include split sleep periods) _____

P. What time do/did you typically get up from your last sleep period before reporting to work again? _____

Q. During NS/REV, did you sleep straight through or take naps? *Straight thru Napped*

If naps, identify how many and duration (please specify clock hours) _____

R. How many total hours of *quality* sleep do/did you obtain in a 24-hour period on a typical NS/REV? _____

S. How many years have/did you work NS/REV? _____

T. Do you feel you obtain adequate daytime sleep when you work NS/REV? (Circle one)

Not at all Some of the time Most of the time All the time